

Irrigation and Water Management

SLO Creek Farms

Louis Lefebvre

2/14/2012

Volume 1, Issue 1

Your business tag line here

Use this space to give a brief summary of your company’s products and services

Table of Contents

The Purpose and Benefit of a Booklet 1

Existing System and Associated Issues 1

Energy Analysis: Current Irrigation Scheme. 2

Water Useage: Current Irrigation Scheme 4

Irrigation Alternatives 5

Using Text Boxes 6

Resizing a Text Box 6

Nudging a Text Box into Position 6

Products or Services 7

Order Form 8

# The Purpose and Benefit of a Booklet

This manual is about reducing the costs associated with small scale pressurized irrigation schemes. Quite frequently irrigation systems are designed, constructed, and analyzed chiefly with capital costs in mind. Without paying adequate attention to operating costs, these irrigation schemes may be cheap to install but may be expensive to operate.

# Existing System and Associated Issues

The current system at SLO Creek Farms uses a form of overhead sprinkler irrigation to water 40 acres of apple orchards. There is a fairly complex well system that taps into a relatively shallow groundwater basin. The complexity of the well system lies not in the hydraulic or distribution systems but in the multiple users of the well system. SLO Creek Farms, the San Luis Obispo Land Conservancy, the Gable Family, and possibly other domestic users have been identified as users of the well system. Thusly, at this time it is not well understood who is using what well, when, and how long they are using it for. This makes analysis of past energy statements difficult. Furthermore because of communication difficulties, details of the existing irrigation system are lacking. These details include pump specifications, more specifically pump brand, model numbers, and characteristics curves.

Putting aside what is unknown about the existing system, there is quite about that is known. Currently the orchard is irrigated via sprinklers that are a top a (roughly) 10 ft. tall riser pipe. For the system to provide adequate coverage it must operate at high pressures and for extended period of time. Additionally it was discovered that four pumps most be operated simultaneously to obtain adequate pressures.

Figure Apple orchard using inefficient overhead spray irrigation.



Irrigating the orchard in this manner has proved troublesome. Overhead water seems to be the chief cause of many diseases that the crop endures. Apple scab is the is the primary disease at SLO Creek Farms. This disease and others like it are propagated and fueled when the fruit is exposed extended periods of moisture, high winds, and rain. Long durations of overhead irrigation mimic these conditions very well.

Figure 2. Two apples with apple scab



In addition to disease and compromising the aesthetics of the fruit overhead watering is wasteful. Irrigating the crop in this manner exhibits high losses of water to wind and evaporation. In some instances as much as %50 or more of the water coming from overhead irrigation is lost to evaporation alone. Lastly, using overhead irrigation is energy intensive. Pumps must be operated at high pressures and at low flows to get adequate crop coverage. High pressures require high energy inputs and low flows require long watering durations creating a multiplier effect in terms of pump energy consumption.

# Energy Analysis: Current Irrigation Scheme Though exacting details regarding well pump and motor specifications, general hydraulic system layout, and current operational tactics are lacking a rough estimate of potential energy savings is examined. It is currently understood by the author that four pumps on the farm must be operated or at least *are* being operated simultaneously to have adequate pressure and flow under the current irrigation scheme. This requires a total of 45 horsepower (HP) or 34 kilowatts (kW). For the year of 2011, looking at only two PG&E energy statements (the author presumes that each of the four wells is on its own meter), total energy requirements for pumping in the current irrigation scheme resulted in a total of 14300 kilowatts hours (kWh).

This means that if all four pumps were included on these two energy statements that they were operated for about 420 hours , resulting in $3000 being spent on pumping energy alone during the year of 2011. However if this bill does in fact represent the energy statement for only two wells then the total energy consumed for pumping would be nearly 30000 kWh (assuming that the bill would roughly double when accounting for double the number of similar pumps operating similarly) costing $6000 annually. Because the flowrates coming from each of these pumps is not known, the operating efficiency of each pump cannot be determined. However it is fair to assume they are operated within the range of %40-%80 efficient, with %80 percent efficiency being the very high for most pumps.

To reduce pumping energy requirements, the pumping system needs to be operated at higher efficiencies and/or at lower horsepower. Shifting pump operating points at a given horsepower will only minimally effect power consumption relative to operating at a lower horsepower. Luckily all four of the pumps can be operated at a lower horsepower. However at the lower horsepower operating points, the pump will be able to deliver less pressure at a given flow. This jeopardizes the adequacy of continuing with current irrigation schemes.

Figure Regular monitoring of power meters is a quick and easy way to gauge energy use.



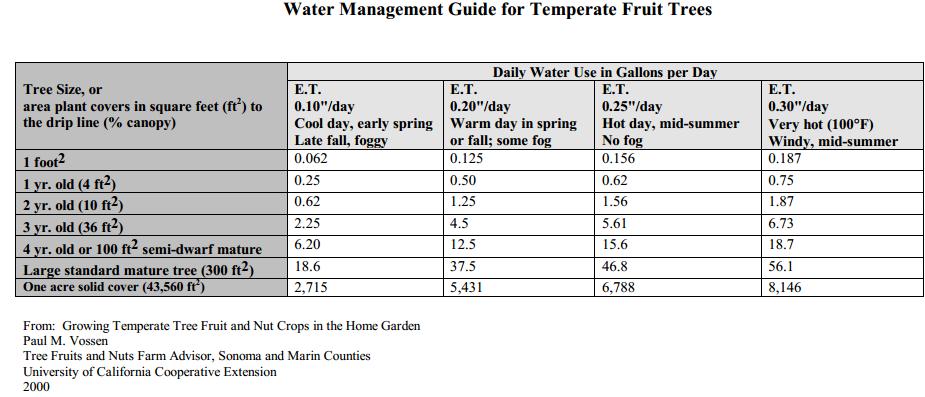
# Water Useage: Current Irrigation Scheme

SLO Creek Farms operates from a private groundwater supply. Thus far no information is known about volumetric water withdraw from any of the wells and can only be calculated making many assumptions and using the two well energy statements.

Assuming that the well system at SLO Creek Farms was pumping for 420 hours during the 2011 year, as estimated in the previous section of this report, is the basis for the water use estimates to follow. Another assumption is that all the pumps were operating, at 175 gallons per minute (GPM) at 200 feet of head or about 85 pound per square inch. The chosen operation point on which the analysis is based is within the operational capacity for all four pumps on the property.

Water flowing at a rate of 175 GPM for 420 hours out of four pumps amounts to roughly 18 million gallons of water used in 2011. Most all of this irrigation occurred in the months of June, July August, and October. For the month of September, according to the energy statement, there was no pump energy useage, which is highly suspect and could be steering this estimate toward the conservative side.

Much of this water does not even benefit the crop. High evapotranspiration rates during the California summer persist, and cause high water loss before touching the ground let alone penetrating to the root zone. According to the table below and assuming all the water from the sprinklers makes it to the ground SLO Creek Farms could be losing in the range of 2-6 gallons of water per day per tree from evapotranspiration alone.



# Irrigation Alternatives

The ideal solution in terms of an irrigation scheme’s energy and water consumption is to not irrigate at all. This is otherwise known as dryland farming or dry farming. Neighboring apple orchards have been doing this for many years with great success even though they are located further from San Luis Creek than SLO Creek Farms and presumably have a greater depth to the groundwater table. However this implies a certain amount of risk to SLO Creek Farms. The risk lies in the uncertainty of crop yield as a result of not irrigating. Maintaining the current irrigation infrastructure does provide a safety net, in the event the crop demonstrates any mal-effects from not irrigating.

Another irrigation solution would be to use drip irrigation. Drip irrigation will provide the following benefits:

1. Eliminate the fruit’s extended exposure to moisture caused by overhead sprinklers
2. Reduce water lost to evaporation and wind
3. Reduce pump energy requirements
4. Provide operational flexibility for flood resistance, dry farming, and/or optimization

Drip irrigation is the most widely used form of orchard irrigation and should be more than adequate in service of SLO Creek Farms.

A third irrigation alternative is to use soaker hose in lieu of drip irrigation. Soaker hose will provide many of the mentioned benefits of drip irrigation however will be less water efficient, and could provide increased flood resistance.

# Using Text Boxes

The pull quotes and clip art in this template are contained in text boxes. A text box offers a flexible way of displaying text and graphics; it’s basically a container. You can move a text box around, positioning it just where you want it; you can resize it into a tall narrow column or into a short wide column, or even rotate it so that the text reads sideways.



## Resizing a Text Box

To move a text box, select it so that it has either a hatched or dotted border. Then, move the cursor over the border of the text box until the pointer becomes a four-headed arrow, and then drag the text box to its new location.

## Nudging a Text Box into Position

Sometimes you may want to move a text box slightly in one direction or another, but you find that using the mouse doesn't give you the degree of control you want. You can achieve finer control of movement by using the arrow keys on your keyboard.

To do so, click anywhere in the text box so that its borders become visible, and then click a border to select the text box. Next, press the arrow keys to move the text box. A single keystroke moves the text box a single increment, while holding an arrow key down keeps the text box moving.

“Place an interesting sentence or quote from the text here.”

If granularity of movement is really important to you and you want as much control as possible, you can cover less distance with each keystroke by first zooming in on the document. To cover a greater distance with each keystroke, zoom out. You can zoom out or in by clicking **Zoom** on the **View** menu.

# Products or Services

|  |  |
| --- | --- |
| product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type | product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type |
| product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type | product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type |
| product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type | product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type |
| product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type | product or service  Describe the product or service here. Include a brief description and any features.  Price: $00.00  Item #: 000000  Type: Type |

# Order Form

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Last Name | | |  | | | | | | | | | | | | | | | |
| First Name | | |  | | | | | | | | | | | | | | M.I. |  |
| Address | |  | | | | | | | | | | | | Apt./Unit | | | |  |
| City |  | | | | | | State | | |  | ZIP Code | |  | | | | | |
| Phone | | ( ) | | | | | E-Mail | | |  | | | | | | | | |
| Method of payment | | | | | ❑ | | | | ❑ | | | | | | ❑ | | | |
|  | | | | | Check | | | | VISA | | | | | | MasterCard | | | |
| Credit Card # | | | |  | | | | | | | | | Exp. Date | | | | |  |
| Name as it appears on card | | | | | |  | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| Signature | | | | | | | | | | | | | | | | | | |
| Item No. | | | | | | | | Price | | | | Qty. | | | | Amount | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
|  | | | | | | | |  | | | |  | | | |  | | |
| Subtotal | | | | | | | | | | | | | | | |  | | |
| Tax | | | | | | | | | | | | | | | |  | | |
| Shipping | | | | | | | | | | | | | | | |  | | |
| Total | | | | | | | | | | | | | | | |  | | |

Company Name

Street Address

Address 2

City, ST ZIP Code

Phone (325) 555-0125

Fax (325) 555-0145

Web site address

We give you three easy ways to order:

* Visit us on the Web
* Fill out the order form and mail it to us
* Call us

